PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
OP100850SKI		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI2004/000614	15.10.2004	15.10.2003
International Patent Classification (IPC) or national classification and IPC		
A23J 1/20, A23J 3/08, A23J 3/16		
Applicant		
Uniq Bioresearch OY et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:

      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))

      _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

   ☒ Box No. I Basis of the report
   ☐ Box No. II Priority
   ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   ☐ Box No. IV Lack of unity of invention
   ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   ☐ Box No. VI Certain documents cited
   ☐ Box No. VII Certain defects in the international application
   ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
27 [illegible] 2005	14.10.2005
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Form PCT/IPEA/409 (cover sheet) (April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/FI2004/000614

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-29 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 30-32 received by this Authority on 27-07-2005
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-3 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/FI2004/000614

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims		NO
Inventive step (IS)	Claims	1-20	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Cited document:
D1: WO9955170, (page 9, line 9-33)

D1 shows a method for modifying the structure of whey proteins. Sulfitolysis of the disulfide bond of the protein results in two sulfhydryl groups. The sulfhydryl groups are then oxidized with air oxygen or with another oxidizing agent and heated so that new disulfide bonds are formed. The end product has functional properties such as dispersability, emulsification and gelation according to the degree of modification.

The claimed invention, according to claim 1, 8, 11 and 18 differs from D1 in that the heating proceeds for less than 15 minutes. Nothing is said about reaction time in D1.

The heat treatment, according to the invention, is considerably shorter than what is traditionally used. A skilled person working in the field of food industry would not have used such a short heat treatment to strengthen the structure of the protein. The claimed invention therefore is not considered to be obvious. Accordingly the claimed invention involves an inventive step. The invention, according to claims 1-20 is also considered to be industrially applicable.

Claims

1. A method for strengthening the structure of a protein-containing food product during a pasteurization heat treatment of said product by forming disulfide bonds between the proteins to form a protein space network, **characterized** in that the method comprises
– adding modified protein to said product before heating, which protein is modified by cleaving at least one disulfide bond originally present in said protein to obtain free sulfhydryl groups, and
– heating said product for 15 minutes or less to cause an interchange reaction by said free sulfhydryl groups to form said structure strengthening disulfide bridges between proteins.

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2. The method of claim 1, **characterized** in that said heating time is 15 seconds to 14 minutes, preferably 1–10 minutes, more preferably 1–3 minutes.

3. The method of claim 1 or 2, **characterized** in that said heating temperature is 70–85 °C, preferably 70–80 °C, more preferably 72–75 °C.

4. The method of any of the preceding claims, **characterized** in that said protein has been modified by contacting it with sulfite ion forming reagent, such as alkali metal or earth alkali metal sulfite, hydrogen sulfite or metabisulfite or combinations thereof, to sulfonate said protein.

5. The method of any of the preceding claims, **characterized** in that the amount of free sulfhydryl groups in the total protein of the product before the interchange modification is 0.5–60 μmol/g protein, preferably 5–20 μmol/g protein.

6. The method of any of the preceding claims, **characterized** in that said modified protein comprises whey protein or soy protein.

7. The method of any of the preceding claims, **characterized** in that said food product is yoghurt, pudding, spread, other milk product, dough, animal fodder or pet food.

8. A method for preparing a protein-containing food product having protective functional properties, **characterized** in that the method comprises

– adding modified protein to said product, which protein is modified by cleaving at least one disulfide bond originally present in said protein to obtain free sulfhydryl groups, and

– heating said product for 15 minutes or less to cause an interchange reaction by said free sulfhydryl groups to further cleave other disulfide bridges between proteins to obtain free sulfhydryl groups providing said functional properties.

9. The method of claim 8, **characterized** in that said heating time is 15 seconds to 14 minutes, preferably 1–10 minutes, more preferably 1–3 minutes.

10. The method of claim 8 or 9, **characterized** in that said heating temperature is 70–85 °C, preferably 70–80 °C, more preferably 72–75 °C.

11. A protein-containing food product comprising a protein space network strengthening the structure of said product, which network is formed in a pasteurization heat treatment by disulfide bonds between proteins, **characterized** in that said protein network has been created by adding modified protein to the product before said heat treatment, which protein is modified by cleaving at least one disulfide bond originally present in said protein to obtain free sulfhydryl groups which have formed said structure strengthening disulfide bonds in an interchange reaction during a heating of 15 minutes or less.

12. The protein-containing product of claim 11, **characterized** in that said heating time is 15 seconds to 14 minutes, preferably 1–10 minutes, more preferably 1–3 minutes.

13. The protein-containing product of claim 11 or 12, **characterized** in that said heating temperature is 70–85 °C, preferably 70–80 °C, more preferably 72–75 °C.

14. The protein-containing product of any of the claims 11–13, **characterized** in that said protein has been modified by contacting it with sulfite ion forming reagent, such as alkali metal or earth alkali metal sulfite, hydrogen sulfite or metabisulfite or combinations thereof, to sulfonate said protein.

15. The protein-containing product of any of the claims 11–14, **characterized** in that the amount of free sulfhydryl groups in the total protein of the product before the interchange modification is 0.5–60 µmol/g protein.

16. The protein-containing product of any of the claims 11–15, **characterized** in that said modified protein comprises whey protein or soy protein.

17. The protein-containing product of any of the claims 11–16, **characterized** in that said food product is yoghurt, pudding, spread, other milk product, dough, animal fodder or pet food.

18. A protein-containing food product having protective functional properties, **characterized** in that said product comprises free sulfhydryl groups created by adding modified protein to the product before pasteurization heat treatment, which protein is modified by cleaving at least one disulfide bond originally present in said protein, to obtain free sulfhydryl groups to further cleave other disulfide bonds between proteins during a heating of 15 minutes or less to obtain free sulfhydryl groups providing said functional properties.

19. The protein-containing product of claim 11, **characterized** in that said heating time is 15 seconds to 14 minutes, preferably 1–10 minutes, more preferably 1–3 minutes.

20. The protein-containing product of claim 11 or 12, **characterized** in that said heating temperature is 70–85 °C, preferably 70–80 °C, more preferably 72–75 °C.